Attachment J – Relative Comparison Residual Surface to Current Surface Sediment Concentrations based on Sediment Core Data

Introduction

The ROD for the lower 8.3 miles of the LPR specified that the river will be dredged bank to bank (approximately 3.5 million cubic yards) so that a cap can be placed without increasing the potential for flooding and to allow continued commercial navigation in the lower 1.7 miles. Depth of dredging is estimated to be 2.5 feet, except in the 1.7 miles of the federally authorized navigation channel closest to Newark Bay. After dredging each area, the exposed surface concentration maybe higher than current surface sediment concentrations and under certain conditions, resuspension of sediments from the residual surface before it is capped can be significant.

The purpose of the analysis is to examine the changes in vertical contaminant concentration profiles in sediment cores on a model grid cell basis, and compare the exposed concentrations at depth of dredged cut to the current surface concentrations. In a parallel analysis (see Attachment F), the impact of the residuals during the period between dredging and capping was quantitatively evaluated using the LPR numerical model.

Sediment Dataset

The sediment data from the years 1990 to 2013 and River Mile (RM) 0 to RM 8.3 were included in this analysis. All field duplicates were identified and averaged with the parent samples. Non-detect concentrations were also used in the analysis at one-half the detection limit, except for the summation of Total PCBs and Total 4,4'-DDx, where only detected concentrations were included in the calculation. However, if the summation of Total PCBs or Total 4,4'-DDx was equal to zero, then Total PCBs or Total 4,4'-DDx were set equal to one-half of the highest detection limits.

Analysis Approach and Results

Sediment samples that fell inside or close to each model grid cell were identified, and a comparison was made between the exposed contaminant concentrations in sediment cores at the depth of the dredge cut (i.e., exposed concentrations) and surface concentrations. Approximately 30 percent of the model grid cells had no sediment core data and majority of model grid cells (approximately 55 percent) had data from less than two sediment cores (Tables 1 and 2). Table 3 summarizes the average ratio of exposed concentrations to surface concentrations for four contaminants per model grid cell. The table also indicates the maximum ratio per model grid cell and the contaminant with the maximum ratio. The maximum ratio changes per model grid cell are presented in Figure 1. The ratios were categorized into six classes, 0-2, 2-4, 4-6, 6-8, 8-10, and greater than 10. For the model grid cells that had no sediment core data, the model-predicted exposed concentrations to surface concentrations ratios were used and represented by the cross-hatched symbol in Figure 1.

Observations drawn from the analysis of the exposed concentration to surface concentration ratios from the sediment cores are:

- In approximately 79 percent of the model grid cells, the exposed concentrations are higher than the surface concentrations by more than a factor of 2. In approximately 50 percent of the model grid cells, the concentrations are higher by more than a factor of 4. The concentrations are higher by more than a factor of 10 in approximately 27 percent of the model grid cells.
- Concentrations decreased by less than a factor of 1 in approximately 14 percent of the grid cells and decreased by a factor of less than or equal to 2 in approximately 10 percent. Decreases by more than a factor of 10 were calculated in 5 percent of the cells.

The higher exposed concentrations in such a large fraction of the area indicates that control of dredging residuals is critical and the areas with elevated concentrations should not be left open for a long period of time. These higher exposed concentrations present an increased risk due to resuspension into the water column if higher shear stress conditions exist when they are open. Therefore, it will be important for multiple lifts of the cap to be considered with the goal to first stabilize the dredging residual surface.